

# A Strategic Guide to Application-Centric Infrastructure Performance Management

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An ENTERPRISE MANAGEMENT ASSOCIATES® (EMA™) White Paper

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# A Strategic Guide to Application-Centric Infrastructure Performance Management

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# A Strategic Guide to Application-Centric Infrastructure Performance Management

## Overview

Modern IT ecosystems have become incredibly complex; so complex, in fact, that maintaining and managing them requires the collective expertise of a wide range of developers, technology specialists, and IT operations personnel. Each role typically sees end-to-end performance and availability through the lens of its own area of responsibility—the application, the database, the network, the server, the storage array or the storage network, for example. Silo-focused management tools deliver this critical visibility, which gives the tools just enough information to ensure that their corner of the ecosystem performs as expected.

The problem with this approach is that at the business level, the focus is on the application, not on the underlying elements supporting the application. “The business” experiences IT services through a different lens, centered in the user experience and effective delivery of high-performing, utility-grade applications and services. For the most part, the business does not care about databases, networks, servers, or storage environments. It cares about the applications supporting business processes and the daily interactions with customers. If IT’s focus is limited to performance and availability at the silo level, there is a mismatch in alignment between IT’s objectives and those of line of business.

At the same time, the business value of today’s IT organizations is increasingly judged by its ability to deliver applications that drive business value and deliver an optimal user experience. Yet in this modern era of agile development, cloud-based delivery, containers, and microservices, many IT organizations are struggling with new requirements to improve the user experience by effectively managing applications in the context of the infrastructure supporting them.

They are finding, however, that managing dynamic applications is far different from managing technology silos. The vast majority of today’s applications span multiple silos, often in a shared or multi-tenant infrastructure. They are composed of hundreds of separate technology components and are connected via Application Programming Interface (API) systems, service buses, and middleware. In addition, the highly fragmented set of silo tools underpin a very unpredictable and constantly changing relationship of applications to the infrastructure. Due to this complexity, performance and availability can be a problem, and root cause analysis is often difficult or impossible.

IT organizations need tools capable of helping them evolve from silo-focused to application-focused management techniques designed to transform groups of diverse technology silo experts into cross-functional application support teams.

This Enterprise Management Associates (EMA) white paper describes the characteristics of modern applications that make both application- and infrastructure-focused management capabilities essential elements of modern management tools portfolios. It describes new tooling capabilities focusing on Application-centric Infrastructure Performance Management (App-centric IPM), a new approach to monitoring and managing the impact of infrastructure performance on application performance. It also highlights the role of App-centric IPM as complementary to traditional Application Performance Management (APM) toolsets, most of which lack the visibility and support to infrastructure elements that can dramatically impact application performance and availability.

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## IT Performance Management

Tools supporting both infrastructure management and application management are essential to troubleshooting performance issues. Applications and their related application services typically share components with other applications and services – sometimes hundreds or thousands of them; if any one component in a shared infrastructure performs poorly, multiple applications may well be affected.

Likewise, excessive usage by any one application or changing workload patterns in a non-business critical application can cause resource contentions. Such contentions can ripple performance problems through an entire ecosystem, affecting a company's most business-critical applications by slowing down essential processes and grinding business functions to a halt.

Silo-specific tools “go deep” to monitor the technologies underlying the application. Application-focused tools “go broad” to track applications end-to-end, but still rely on silo tools for the underlying metrics required for troubleshooting and root cause analysis. The ideal combination of tooling adds application awareness to infrastructure-focused toolsets, providing IT support personnel with metrics and topologies that serve as a basis for root cause analysis and, more importantly, proactive problem avoidance.

Poor management of execution systems from an end-to-end perspective can result in a variety of problems that can impact budgets and top-line revenue. Examples include:

- Overutilization of a billing subcomponent of a hotel reservation system or cell phone activation process, which can impact customer satisfaction as well as user productivity.
- Inability to relate application performance to infrastructure can result in over- or under-provisioning, cost overruns, and performance problems.
- Business critical applications can contend for shared resources with applications of lower business value degrading the performance of the higher business value application users.
- Poor overall performance adversely impacts the ability to meet business objectives.
- Inadequate tooling and lack of automation create a scenario in which IT personnel become so enmeshed in day-to-day support and troubleshooting that they lack bandwidth to tackle new projects. This inhibits business agility and the ability to adapt to changing market requirements.
- A poor user experience reflects badly on the business and often leads to lost customers.

## Application Performance Management (APM) Capabilities and Gaps

There are numerous APM solutions in today's marketplace. Some are designed to run on-premises and some are hosted in the cloud. Traditional APM solutions pull operational metrics from the wide variety of platforms and technologies that underlie any given application. Once the data is accessible, advanced analytics capabilities utilize a wide variety of (typically patented) analysis, heuristics, and algorithms to “self learn” execution environments, track performance, correlate issues down to specific trouble spots, and, ultimately, proactively notify IT personnel of impending problems.

**Not all APM products monitor every element of the application ecosystem.**

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However, not all APM products monitor every element of the application ecosystem. In fact, most have some visibility gaps. For example, some of the newer, more lightweight APM products monitor primarily from the vantage point of the application server. They lack visibility to elements such as the storage I/O path, which is often the primary cause of infrastructure-related slowdowns

In general, deep-dive troubleshooting and root cause analysis can significantly benefit from a broader range of instrumentation feeding the analytics via connections with outside management solutions, since application-related issues can arise in virtually any segment of the end-to-end execution path.

It is also the case that not every IT organization has access to APM solutions. EMA research consistently finds that only about 50% of today's companies have APM solutions in place. Even if they do have APM in use, not all applications utilize APM due to the relative high cost of instrumenting less business-critical applications. In shared, multi-tenant environments, this can be a significant problem, as applications of both high and low business value can be sharing the same infrastructure components. APM tools can't comprehend when these applications are contending for the same resources and performance of the business-critical application is unacceptably degraded. This means that a significant percentage of IT organizations are still attempting to manage multiple complex, potentially inter-related applications with silo-focused toolsets, most of which lack application awareness.

Regardless of whether an IT organization has an APM solution or not, a lack of key features/functions means that many are under-automated and lack an ability to contextualize and correlate dynamically evolving infrastructure issues and their impact on application performance.

## Common APM Gaps

Table 1 shows the most common gaps in existing toolsets and analytics. Gaps in coverage create gaps in visibility. With little insight into the relationships between infrastructure elements and the “glitches” that can occur within an application, troubleshooting becomes a labor-intensive, time-intensive, and error-prone process.

COMMON APM GAPS
Input from storage and storage network monitoring
Input from Synthetic Transactions
Input from Real User Monitoring (RUM)
Input from middleware monitoring
Input from API monitoring
Input from network monitoring

Table 1: Common APM gaps that complementary third-party solutions could fill

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Most APM solutions, for example, lack visibility into storage and workload I/O behavior, which are a common cause of application performance problems. If an application starts developing new I/O patterns, perhaps due to new users, whose behavior negatively impacts a storage array that is shared with another application, the APM solution will be ineffective in understanding the cause of such performance problems. And while the majority of today's companies run synthetic transactions for at least some applications, few APM solutions incorporate findings from synthetic tests into their correlation and analysis algorithms.

In addition to information gathered and analyzed from instrumentation and tooling, application assurance also requires an understanding of business-focused requirements that should drive management processes. They include:

- *Business Value Priorities:* How important is a given application to the business? If resource contention occurs, which application takes precedence in terms of service assurance or restoration?
- *Service-level requirements:* What are the performance and availability requirements for a given application, and what tools are in place to measure and report service levels? Is real-time identification and resolution of problems a requirement? Will the monitoring and measurements tools be able to ingest and analyze the vast amounts of data in real-time?
- *Understanding "what's normal":* Too many IT organizations have difficulty managing application performance because they lack visibility to what is normal. Normal behavior can vary based on time of day, day of month, etc. Tools that track historical performance can be extremely useful to determine performance drift over time, and for detecting performance problems before they actually occur.
- *User context:* Who is the user, what types of service levels does he/she expect, and what was he/she doing at the time of a given application issue?

Each of these gaps can be filled in part by application-aware management solutions capable of linking infrastructure performance to application execution.

## Achieving Effective Service Delivery with App-Centric IPM

Bridging the gaps between application requirements and supporting the underlying infrastructure requires granular, holistic visibility that enables the correlation of application performance across cloud, virtual, and grid layers down to the individual servers, storage arrays, and switching components. This establishes a view of the infrastructure configuration that is contextually relevant to applications hosted across hybrid data centers. Application and infrastructure owners must both know where the applications live on the infrastructure at any point in time. Further, since modern application and infrastructure environments often undergo rapid application workload changes to meet evolving business requirements and technological enhancements, performance management tools are only effective if they can detect and adapt to these changes in real time, with response times measured in milliseconds. They must understand how applications are behaving and stressing the infrastructure. Unlike silo-specific tools, which can't detect changing workload behavior in the context of the application and don't understand the business value priority of the applications, App-centric IPM solutions leverage this comprehensive information to rapidly identify service improvements for every level of the application-hosting environment.

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App-centric IPM is architected to operate complementary to any existing application-specific toolsets. For instance, APM solutions are more accurate and responsive in detecting application states when they incorporate storage, networking, and other infrastructure information. By applying advanced analytics to collected application and infrastructure data, impending problems can be rapidly acknowledged by identifying conditions that are inconsistent with “normal” performance behavior. For instance, a change in I/O access patterns may indicate a change in caching or shared memory functions that will directly impact application performance, but which would be undetectable by using APM solutions alone. This approach fundamentally changes the role of IT management from principally engaging in reactive “firefighting” to enabling proactive problem prevention. Applying analytics to holistic visibility allows app-centric IPM implementations to rapidly identify a wide range of opportunities for performance improvements and cost reductions. These include:

- Predicting performance requirement trends and identifying future contention issues
- Determining optimal sizes, configuration, and placement of virtual machines
- Creating dynamic tiers of application-hosting services that consistently meet workload requirements without over-provisioning resources
- Identifying targets (such as server, network switch ports, storage resources, and virtual machines) that can be reliably consolidated to boost performance while reducing costs
- Indicating opportunities for repurposing or retiring unused infrastructure resources

Taking this concept a step further, app-centric IPM can be used to synthetically model workload requirements before an application is even implemented. Again, analytics plays a key role in this process because it creates a hypothetical simulation that applies a planned application hosting environment to an existing infrastructure. This allows IT architects to identify any unexpected interactions with other components in the environment that they may not otherwise consider. Different application deployment scenarios can then be modeled to identify the one that produces the most efficient and reliable performance. It can also identify breaking points in the infrastructure and under what conditions changes in workload behavior will cause significant response time problems.

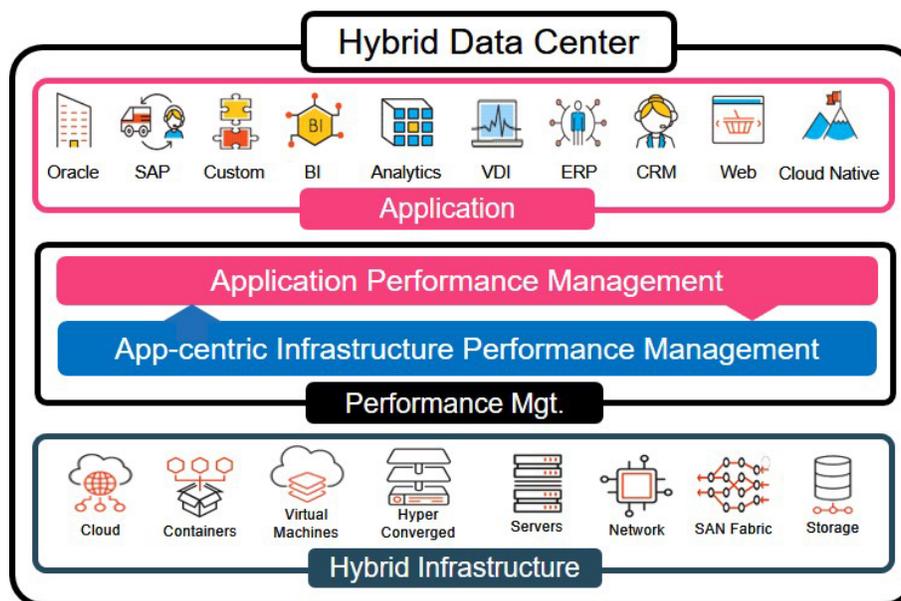


Figure 1: The Role of App-centric IPM

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While app-centric IPM is principally targeted at optimizing application service delivery, it can also have a profound effect on streamlining management practices. Since data is collected and correlated across all management domains, application and infrastructure management teams can review the same performance information and understand how it relates to their particular support responsibilities. A consistent view of the entire IT ecosystem can then be presented in a way that is relevant to individual administrator roles, but still reflects the state of the broader environment in the context of the application. For instance, the root cause of failure events or instances of performance degradation are clearly identified, so the responsible administrator can immediately focus on resolving the issue rather than engaging in finger pointing with their peers. Perhaps even more beneficial, app-centric IPM promotes cross-functional collaboration across siloed management teams, ensuring new or changing infrastructure services are more efficient, reliable, and cost-effective.

## Efficient App-Centric IPM with Virtual Instruments

As an example, app-centric IPM solution provider, Virtual Instruments, offers complementary, integrated solutions for establishing holistic visibility across the entire IT ecosystem. At the infrastructure level, the vendor's VirtualWisdom platform continuously monitors production environments across physical, virtual, and cloud layers. Analytics are applied to the collected information to transform a sea of data into actionable outcomes that ensure service availability by finding potential performance and availability problems before they become business-impacting. To support comprehensive storage performance testing and validation, the vendor also offers Load DynamiX Enterprise, which measures I/O performance and analyzes storage workload profiles from production environments. This storage intelligence can be used to help determine the optimal storage systems and configuration necessary to support specific workloads, and realistic workload models will identify the conditions that will cause the storage environment to hit performance limits.

Completing the app-centric IPM picture, Virtual Instruments is now integrating the Xangati platform, an IPM solution purpose-built to provide actionable intelligence on hybrid-cloud and virtualized infrastructures to optimize the performance of applications and workloads, into VirtualWisdom. Xangati, acquired by Virtual Instruments in 2016, adds continuous monitoring of server and virtualization layers with agentless data collection to VirtualWisdom. Autodiscovery features identify target systems and automatically map application-hosting environments and relationships. For instance, a particular software platform may employ an application subsystem, such as a database, which is hosted on an external cloud. VirtualWisdom will logically link the application subsystem to the software platform so it is evident how the performance on the former will directly affect the performance of the latter. Additionally, VirtualWisdom employs analytics that dynamically detect if there is a contention for resources, performs long-term trend analysis on historical data, and rapidly provides alerts on detection of any abnormal behavior. Together, the integrated Virtual Instrument portfolio empowers application and infrastructure managers with a comprehensive, unified view of how applications and infrastructure relate to each other, their relative business value, and how workload behavior is changing. Virtual Instruments provides the details needed to rapidly and easily identify optimal solutions for accelerating infrastructure performance and reliability while achieving greater cost efficiencies.

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## EMA Perspective

There is a common misconception that individual infrastructure and application performance tools can provide comprehensive support for IT service delivery. In fact, it is not uncommon for solution providers to claim their point products provide “end to end” support, while in truth they are not able to place applications in the full context of the environment. Performance management point solutions do not provide holistic visibility because they do not integrate monitored data from every layer of the IT ecosystem. Correlating events between disparate point solutions is difficult, unreliable, and time-consuming because they rely principally on manual processes and administrator intuition. Also, organizations that employ multiple point solutions must coordinate multiple vendors and deal with unproductive “finger-pointing” and “war rooms” when problems arise. So, in addition to providing limited visibility, point solutions are also costly to license, manage, and maintain.

Unfortunately, businesses have traditionally adopted point solutions as a matter of course. This practice arises from the fact that organization structures typically segment application managers and infrastructure managers into completely independent and autonomous groups, allowing them each to select tools specifically targeting their particular area of focus. App-centric IPM solutions break this mold by enabling a single view of the support environment that is applicable to all IT support and operations teams. However, achieving this requires APM and infrastructure management solutions that are deployed as compliments to each other. Getting support teams to adopt an integrated APM/IPM solution suite will likely require some executive-level vision as well as cultural changes across the workforce, but it is the most effective means for ensuring IT goals align with business goals, rather than the other way around.

Enabling effective and efficient high-performance IT application services requires a consolidated approach to data collection and analysis that is truly “end to end.” Management practices must be able to rapidly correlate application performance with the underlying infrastructure components to support them. Only an app-centric IPM solution, such as the portfolio offered by Virtual Instruments, is able to provide the comprehensive intelligence for making informed decisions that will maximize the value achieved from both IT infrastructure and application investments.

## About Virtual Instruments

Virtual Instruments is a leader in application-centric infrastructure performance management. It provides comprehensive infrastructure instrumentation and performance analytics for enterprise data centers. The company’s solutions give IT teams deep workload visibility and actionable insights into their end-to-end systems across the hybrid data center. Virtual Instruments empowers companies to maximize the performance, availability, and utilization of their production IT infrastructure. Virtual Instruments has over 500 customers, including enterprise IT, cloud service providers, and storage vendors. The privately-held company is headquartered in San Jose, Calif. For more information, visit <https://www.virtualinstruments.com>.

## About Enterprise Management Associates, Inc.

Founded in 1996, Enterprise Management Associates (EMA) is a leading industry analyst firm that provides deep insight across the full spectrum of IT and data management technologies. EMA analysts leverage a unique combination of practical experience, insight into industry best practices, and in-depth knowledge of current and planned vendor solutions to help EMA's clients achieve their goals. Learn more about EMA research, analysis, and consulting services for enterprise line of business users, IT professionals, and IT vendors at [www.enterprisemanagement.com](http://www.enterprisemanagement.com) or [blogs.enterprisemanagement.com](http://blogs.enterprisemanagement.com). You can also follow EMA on [Twitter](#), [Facebook](#), or [LinkedIn](#).

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